Unseen Forces Test Copters

Learn the real science behind the FUN!

For more real science visit:
http://ksnn.larc.nasa.gov/pokemon

Objective

To practice controlling variables to determine rate of descent.

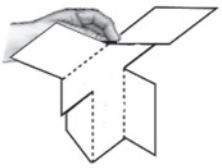
MATERIALS

Per Group
scissors
3 Copters (p. 2-3)
paper clips (for weights)
stopwatch
meter stick

Per Student
science journal

Procedure

1. You will need 3 Test Copters. To make the Copters ready to fly, cut the patterns (p. 2-3) along solid lines and fold along dotted lines. Fold flap A backwards, flap B forward, flap C backward, and flap D forward.
2. Label your Copters 1, 2, and 3.
3. Set stopwatch to zero. Note: You will start the stopwatch when your partner lets go of the Copter and stop the stopwatch when their Copter hits the ground.
4. Working with your partner, hold Copter #1 1.5 m (150 cm) from the floor and drop while your partner times its descent. See diagram 1.
5. Create your own data chat and record time in your science journal.
6. To determine the average rate of descent, repeat Steps 4-5 for two more trials and average your data.
7. Calculate the rate of descent by using the formula R = d/t (Rate = distance divided by time) and record in your science journal.



$$\frac{\text{avg. rate of descent}}{\text{}} = \frac{\text{distance (150 cm)}}{\text{}} \div \frac{\text{time (\# seconds)}}{\text{}}$$

Diagram 1

8. On Copter # 2, change a variable by bending or folding a portion of each blade and repeat steps 3-7.
9. Change the variable of distance by decreasing the height from the floor to 1 m (100 cm) and repeat steps 3-7 for Copter #1 and #2.
10. Add 1-3 paper clips to Copter #3 and repeat steps 3-7.
11. Determine a variable of your choice to change and repeat steps 3-7 on one of the Copters.
12. Create a graph showing the rate of descent for each variable tested.

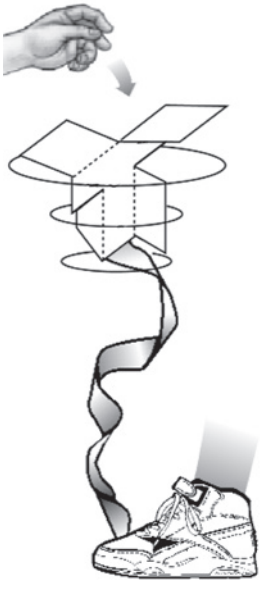


Diagram 2

Conclusion

1. Did all Copters drop the same? Why or why not?
2. What were the variables that you changed in each experiment?
3. Why is it important to keep all other variables constant during an experiment?
4. Calculate the average speed for all of the Copters.
5. Compare your Copter with leaves, animals, or seeds in nature.

Extensions

1. To determine the number of rotations the Copter makes as it descends, (1) tape a piece of cassette ribbon (100 cm) to the bottom of a Copter, (2) stand on the loose end of the ribbon and pull the Copter up so that there are no twists in the ribbon, and (3) drop the Copter as usual. Count the number of twists in the ribbon to determine the number of rotations. Vary the height. See diagram 2.

Unseen Forces Test Copters

Learn the real science behind the FUN! Pokémon Trading Card Game

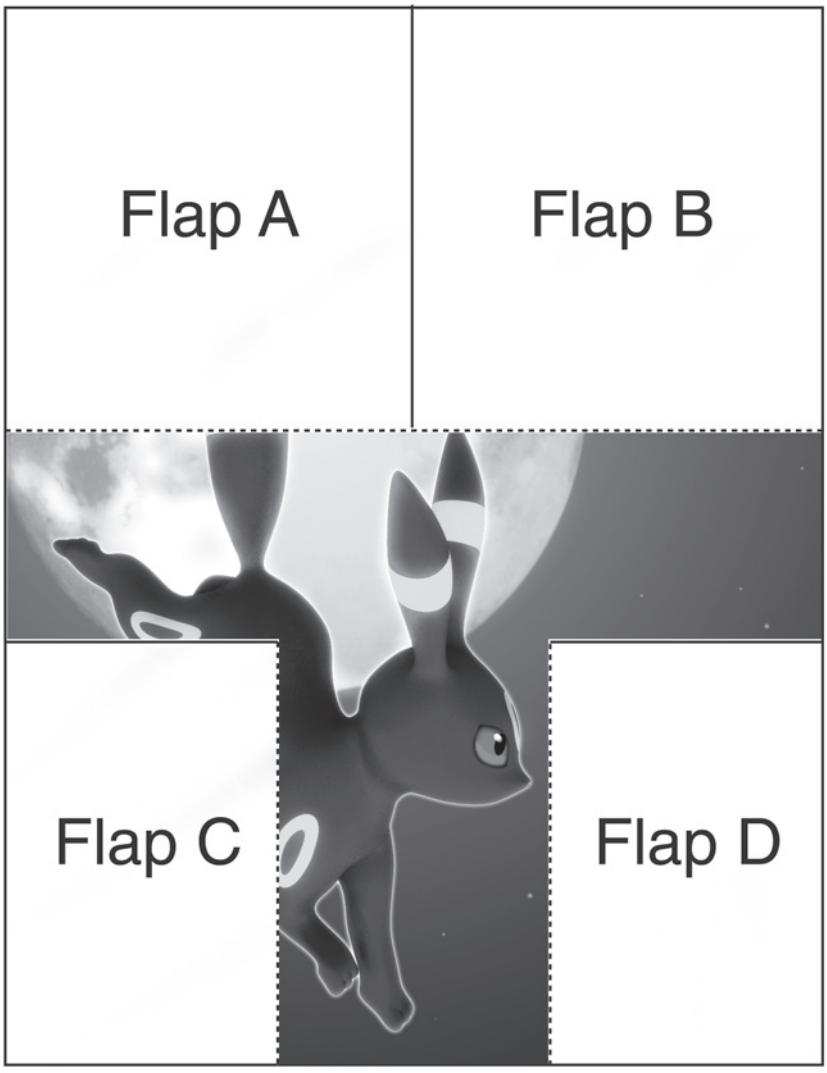
For more real science visit:
http://ksnn.larc.nasa.gov/pokemon

2. After the Copter is dropped, construct a bar graph that shows the relationship between the height and the number of twists.
3. Experiment with various weights of paper and graph the results.
4. Have students determine relationships between the weight, height of launch, shape, and the length of the "blades."
5. Have students determine if the "blades" turn in a clockwise or counterclockwise direction.
6. Compare the flight of the Copters to that of a maple seed or dandelion.

Explanation

Your Copter spiraled down, demonstrating its natural gliding flight that is similar to the leaves, petals, and seeds in nature. It changed speed and maybe even direction when you changed the variables. As you observe nature, you will see that no two species of leaves, petals, or seeds are exactly the same. Nature has changed the variables so they all have their own unique characteristics that suit them best for their environment. When conducting flight research, scientists observe the characteristics of objects in nature and how they glide. Scientists will sometimes try to duplicate their observations and then change variables to determine what would work best for a glider, plane, or space shuttle.

Pattern



Unseen Forces Test Copters

Learn the real science behind the FUN!

Pokémon Trading Card Game

For more real science visit:
http://ksnn.larc.nasa.gov/pokemon

Patterns